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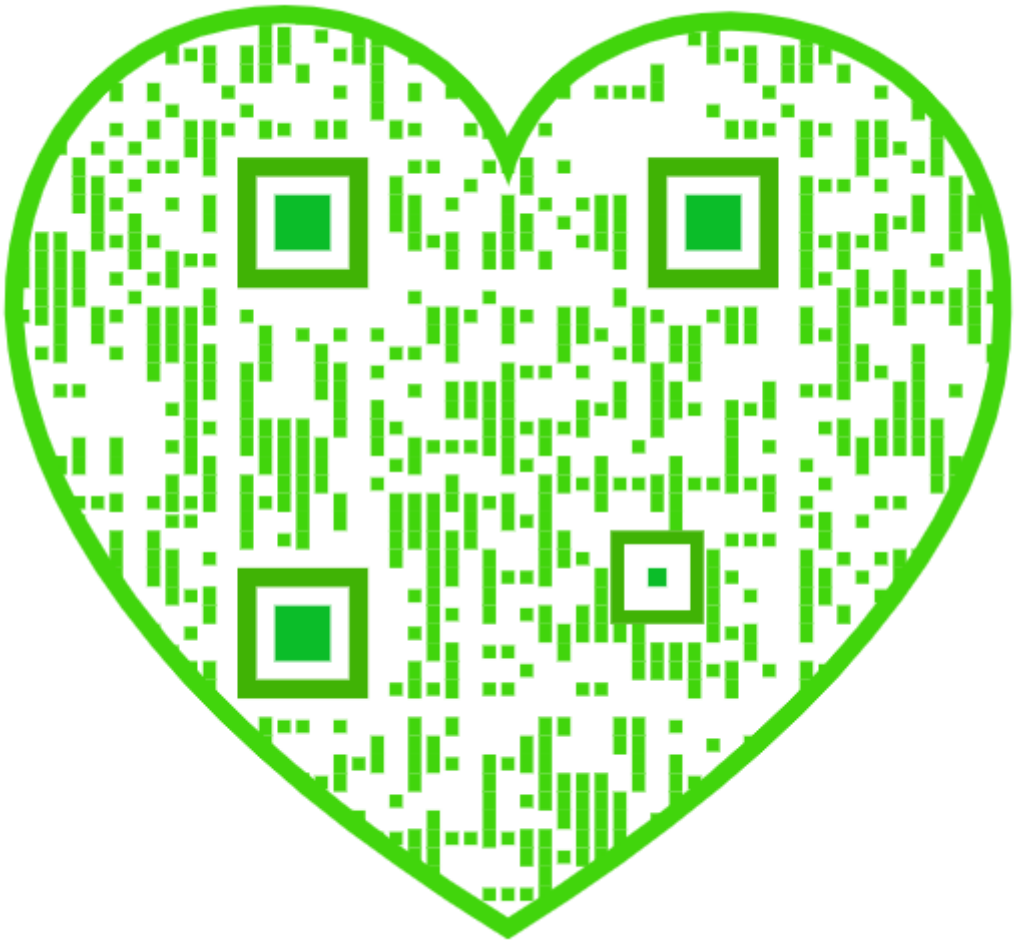

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Issued July 27, 1912.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ANIMAL INDUSTRY.—BULLETIN 147.

A. D. MELVIN, CHIEF OF BUREAU.

FATTENING CALVES IN ALABAMA.

INVESTIGATIONS IN COOPERATION WITH THE ALABAMA AGRICULTURAL EXPERIMENT STATION.

BY

DAN T. GRAY,

Professor of Animal Husbandry, Alabama Polytechnic Institute,

AND

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D. OF A.
AUG 12 1912

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Animal Industry,
Washington, D. C., January 30, 1912.

Sir: I have the honor to transmit, and to recommend for publication as a bulletin of this bureau, a manuscript entitled "Fattening Calves in Alabama," by Prof. Dan T. Gray, of the Alabama Agricultural Experiment Station, and Mr. W. F. Ward, of the Animal Husbandry Division of this bureau.

The paper gives the details of three experiments in fattening calves in Alabama, two lots being fed during the winter on separate farms with various southern feeds, and the third lot carried through the winter and subsequently fattened while on pasture. These experiments form a part of the investigations in beef production which are being carried on by cooperation between the Alabama Experiment Station and this bureau, the work on the part of the bureau being under the direction of Mr. George M. Rommel, chief of the Animal Husbandry Division.

Respectfully,

A. D. Melvin,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

CONTENTS.

	Page.
Introduction	7
Plan of the work	8
I.—Winter fattening of calves on cottonseed meal and hulls, corn-and-cob meal, and alfalfa hay	9
Kind of calves used	9
General plan of the work	10
Shelter and lots	10
Method of feeding and handling the calves	10
Character and price of feeds	11
Daily rations	11
Weights and gains	13
Quantity and cost of feed required to make 100 pounds gain	15
Prices realized on each kind of feed when prices of the other feeds are fixed	16
Financial statement	17
Slaughter records	19
Summary	20
II.—Fattening calves in winter on cottonseed meal and hulls and pea vine hay	22
The calves	22
Plan of the work	23
Prices and quality of feeds	23
Daily rations	23
Weights and gains	24
Quantity and cost of feed required to make 100 pounds gain	24
Amount realized on each ton of feed when prices of the other feeds are fixed	25
Financial statement	25
Slaughter records	26
Summary	26
III.—Wintering calves followed by fattening on pasture	28
Plan and object of the work	28
The calves	28
Feed and management	29
The pasture	29
Character and prices of feeds	30
Daily rations	30
Weights and gains	31
Quantity and cost of feed required to make 100 pounds gain	32
Prices realized for feeds as a result of feeding to calves	33
Financial statement	33
Slaughter records	34
Summary	35
IV.—General statement	37
Conclusions	38
Summary of conclusions	39

ILLUSTRATIONS.

Page.

Plate I. Calves used in feeding experiments. Lot 3 (Part I) at beginning of test 8

II. Calves after winter fattening. Lot 2 (Part I) at close of test 8

III. Calves fattening on pasture. Condition of animals five weeks before end of test (Part III) 28

FATTENING CALVES IN ALABAMA.

INTRODUCTION.

The beef-cattle business can be, and usually is, divided into two parts—breeding and fattening. As a rule, the man who raises the calf does not finish it on his own farm for the market; he usually sells it to a neighboring farmer who makes a business of fattening and preparing the calf or steer for the market. Thus the feeder oftentimes has no interest at all in raising the calves. Probably the ideal condition, at least for Alabama and adjacent States, is for the calf to be raised and finished on the same farm. But this ideal condition can seldom be realized because the man who raises the calf has, as a rule, only a few cows and can seldom afford to take the time and trouble to fatten the few calves which these cows bring each year. Even if the small farmer were to fatten these few calves each year he could seldom afford to ship them to the larger markets, so he is at the mercy of the local buyers. As a result of this condition of affairs the professional feeder has developed. His business is to collect calves and steers into carload lots and prepare them for the open market.

The farmer who has as many as 30 breeding cows on his farm should make it a rule to fatten their offspring himself; he can seldom afford to sell the calves to the professional feeder. The feeder usually makes money on the process of fattening, and the man who raises calves in sufficient numbers should keep this extra profit at home. Furthermore, the farmer who has from 8 to 12 calves or steers ready for the feed lot will usually find it profitable to buy a sufficient number of feeders to complete the load, and he can then finish all of them on his own farm.

There are many ways of disposing of beef calves or cattle, and the farmer should be watchful and avoid methods by which money might be lost. It is possible to raise beef cattle properly and by selling them improperly to lose money on the business, in just the same way that it is possible to raise good apples, potatoes, and peaches and lose money on them when the marketing part of the business is not studied and given proper attention. When beef cattle are bred, fed, and marketed in a scientific and businesslike manner, satisfactory profits should be realized. This is proved by the experience of good cattlemen, and by the cooperative experimental work between the Bureau of Animal Industry and the Alabama Experiment Station.

PLAN OF THE WORK.

The farmer who raises calves is often at a loss to know at what age they should be disposed of. The spring calf may be sold the subsequent fall; it may be fattened during the winter months and sold as a fat yearling calf; it may be kept on the farm until it is from 2 to 4 years of age and then sold to a professional feeder; or, the mature steer may be fattened on the farm where it was raised instead of being sold to a feeder. On account of these various methods which it is possible to adopt for disposing of beef animals, the owner is often in doubt as to the most profitable manner of handling and disposing of his crop of calves.

This bureau, working in cooperation with the Alabama Experiment Station, has done several years' experimental work in fattening mature steers for the market.[1] The steers used in these experiments were not raised on the farm where they were fattened; they were purchased from small farmers who sold them for from $2\frac{1}{4}$ to $3\frac{1}{2}$ cents a pound, the price paid depending upon the quality, age, size, and condition of the animals. Excellent profits were realized on all of these cattle with the exception of one lot, but it is probable that some of the farmers who raised the steers lost money on their part of the transaction, as cattle can not be raised and sold at a profit for $2\frac{1}{4}$ cents a pound.

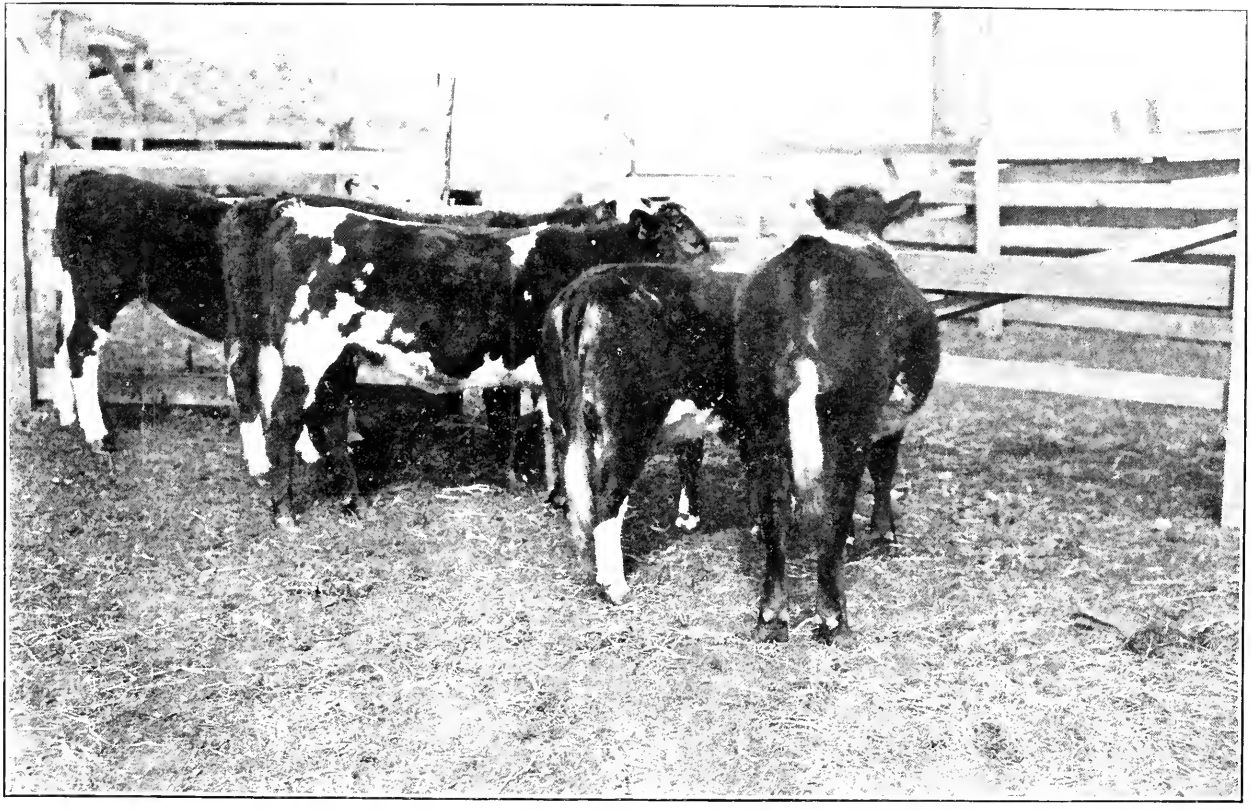
Since the publication of the results of the work above mentioned, many farmers in the South have raised the question, "Why not fatten the animals while they are young?" In the past the farmers and planters insisted on keeping the offspring of their beef cows until they were from 3 to 4 years old, but many inquiries are now made as to the advisability of fattening the calves so as to dispose of them by the time they are a year old.

Two or three points can be urged in favor of this system. First, more breeding animals can be kept upon a farm when the offspirng are disposed of at an early age, than when they are held and sold as steers. Second, the younger the animal, the cheaper each pound of beef is made. Third, the money invested is turned more rapidly when the calves are sold at a young age.

In order that they might be in a position to assist in answering such inquiries, authorities of the Bureau of Animal Industry and the Alabama Experiment Station undertook three experiments in fattening calves, which are hereafter described. The details in this bulletin are accordingly divided into three parts. In Part I the calves were fattened, during their first winter, on cottonseed meal and hulls, corn-and-cob meal, and alfalfa hay; in Part II similar winter fattening was carried on with cottonseed meal and hulls and peavine hay, and in Part III the calves were fed in the winter and fattened during the following pasture season.

[1] See Bureau of Animal Industry Bulletins 103 and 131, and Alabama Experiment Station Bulletins 150 and 151.

Calves Used in Feeding Experiments. Lot 3 (Part I) at Beginning of Test.



Calves After Winter Fattening. Lot 2 (Part I) at Close of Test.

I. WINTER FATTENING OF CALVES ON COTTONSEED MEAL AND HULLS, CORN-AND-COB MEAL, AND ALFALFA HAY.

The main object in doing this calf-feeding work was to determine whether the farmer can afford to raise a good grade of calves and finish them for the market while they are yet less than a year old. Secondary considerations were, of course, involved as well.

In this part of the test the calves were divided into three lots, so that a comparison of certain feeds could be made. The following problems were studied:

1. To learn whether a farmer can profitably raise and fatten calves and finish them for the market by the time they are a year old.

2. To make comparisons of southern feeds and combinations of feeds which can be used for fattening calves during the winter months.

Owing to the fact that a high grade of calves can not be obtained near the Experiment Station at Auburn, Ala., the work was carried on upon the farm of Messrs. Cobb and McMillan, of Sumterville, Ala., with whom the bureau and the station have been in cooperation for a number of years. Messrs. Cobb and McMillan furnished the calves and the feed, and the bureau and the Experiment Station provided a trained man to live on the farm and have personal supervision of the experimental work. Mr. H. J. Chatterton was stationed upon the farm and supervised the work.

KIND OF CALVES USED.

The calves used in this work were high-grade animals. The farmer who raises beef cattle can not afford to raise scrubs, especially the man who expects to finish them for the market while they are young. It would have been absolutely impossible to have made a profit on these calves if they had been scrubs instead of high-grade beef calves. High-priced feeds can seldom be fed profitably to low-priced cattle. It may be possible for a professional feeder to make a profit on scrubs even when high-priced feeds are used, but when such is the case it means that the feeder made the profit at the expense of the man who raised the scrubs. In other words, it means that the feeder did not pay the producer as much for the scrubs as it actually cost to raise them.

The majority of the calves were raised on the farm of Cobb and McMillan, near Sumterville, Ala., where the feeding was done. Some of them were purchased from neighboring farmers in Sumter and adjoining counties. The calves were all well-bred animals, although not purebred. They were grade Shorthorns, Aberdeen-Angus, Here-

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fords, and Red Polls, the majority being from one-half to seven-eighths pure. All had been born the preceding spring, so they were from 6 to 8 months of age when the fattening experiment began. During the summer they had run with their mothers on good pasture, and during this time they demanded practically no attention from the owner, except to see that they were salted and dipped. Both the mothers and the calves were dipped regularly all through the summer months to reduce the number of ticks. Very few ticks appeared on the cattle during the summer time.

On November 17, 1910, when the preliminary feeding began, the calves averaged 338 pounds in weight

GENERAL PLAN OF THE WORK.

When fall arrived and the pastures were exhausted the calves were taken from their mothers and placed in this winter work. They were in excellent condition at this time. The original intention had been to begin the winter feeding early in the fall, to avoid losing any part of the calf fat, but on account of an unavoidable delay the feeding was not begun until the above-mentioned date, so no doubt the calves lost a few pounds in weight after the pastures became short.

On November 17, 1910, the calves were tagged, dehorned, and divided into three lots. Each lot was fed until March 17. 1911, on the following feeds:

Lot 1. Cottonseed meal, cottonseed hulls, mixed alfalfa hay. Lot 2. Cottonseed meal, two-thirds; corn-and-cob meal, one-third; cottonseed hulls; mixed alfalfa hay. Lot 3. Cottonseed meal, one-third; corn-and-cob meal, two-thirds; cottonseed hulls; mixed alfalfa hay.

SHELTER AND LOTS.

The calves were young, so each lot was provided with shelter sufficiently good to turn the cold rains and break the cold north winds. If they had been mature steers the shelter would not have been necessary, but calves will not do well, even this far south, without some protection from the cold winds and rains of the winter months. Each lot was confined in a one-half acre paddock. While the lots were not paved, still they did not become excessively muddy, even during the periods of excessive rain. The ground floors of the sheds were always dry, so the calves had a comfortable and convenient place in which to rest.

METHOD OF FEEDING AND HANDLING THE CALVES.

On November 17, 1910, all the calves were tagged and dehorned. On the following day the individual weights were secured and the 77 calves were divided into three lots as nearly equal as possible in quality, weight, and breeding. The preliminary feeding began November 18, 1910. All of the males were castrated on November

23 and 24. No doubt the results would have been more satisfactory if the calves had been castrated at an earlier age.

The animals were fed twice each day, the morning feed being given about 7 o'clock and the night feed at 5 o'clock. The concentrated feeds were placed in the troughs, each of which was about 12 feet long and 3 feet wide. The hay was fed in separate hay racks. Both the troughs and the racks were under sheds so that the feed never became wet and the calves had comfortable quarters in which to eat. Salt was supplied regularly, also good pure water in clean troughs.

At the beginning and end of the experiment individual weights were taken on two successive days. During the course of the test the total weight of each lot was taken every 28 days.

CHARACTER AND PRICE OF FEEDS.

Cottonseed meal, corn-and-cob meal, cottonseed hulls, and mixed alfalfa hay were all used in this test. The cottonseed meal and the hulls were purchased and hauled to the farm. The corn-and-cob meal and the mixed alfalfa hay were grown upon the farm. All of the feeds were of good quality. The cottonseed meal was fresh and bright; the hay consisted of a mixture of about one-half each of Johnson grass and alfalfa. The corn was grown upon the farm, and before it was fed the whole ear of corn with the shuck was run through a grinder and made into corn-and-cob meal.

The feeds were valued as follows:

Cottonseed meal	per ton..	$26.00
Cottonseed hulls	do....	7.00
Corn	per bushel..	.70
Mixed hay	per ton..	15.00

As a matter of fact the cottonseed meal cost only $25 a ton, and corn was worth only 50 cents a bushel, but the above prices were adopted for the sake of uniformity. These prices have been used in other publications of this bureau, and represent fairly accurately the average prices of feeds in this State

DAILY RATIONS.

More care and skill must be exercised in feeding a young animal than an old one. A 6-year-old ox may be cared for and fed in a careless manner and still no serious results follow; but the young calf will not grow and develop with any degree of satisfaction under a careless system of management and feeding. The younger the animal the greater the skill required to care for and feed it; one case of overfeeding will often throw the stomach and bowels out of condition for weeks.

It will be noticed from the table below that at first the calves were given a very small quantity of concentrated feed, the amount being gradually increased to the end of the test. They were given, from the beginning, all of the hay they would clean up.

TABLE 1.—*Daily ration for each calf (November 17, 1910, to March 17, 1911).*

Period.	Lot 1.			Lot 2.				Lot 3.			
	Cotton-seed meal.	Cotton-seed hulls.	Mixed hay.	Cotton-seed meal.	Corn-and-cob meal.	Cotton-seed hulls.	Mixed hay.	Cotton-seed meal.	Corn-and-cob meal.	Cotton-seed hulls.	Mixed hay.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
November 17 to December 7 (preliminary period)	2.09	5.34	5.10	1.91	0.69	5.77	5.57	1.36	1.69	5.35	4.66
December 8 to January 4 (28 days)	2.69	7.36	5.05	1.85	.92	7.36	5.18	1.85	3.73	7.39	3.70
January 5 to February 1 (28 days)	3.16	7.57	5.24	2.14	1.17	7.57	5.51	2.14	4.67	7.57	3.36
February 2 to March 1 (28 days)	3.63	8.00	5.86	2.70	1.35	8.00	5.51	2.15	4.30	8.00	8.57
March 2 to March 17 (16 days)	3.67	8.88	5.79	3.42	1.71	8.80	5.74	2.00	4.00	8.00	5.60

During the preliminary feeding period each calf in lot 1 received an average of only 2.09 pounds of cottonseed meal each day, and during the last 16 days of the feeding period the calves in this lot received an average daily feed of only 3.67 pounds of cottonseed meal. At one time the daily allowance was raised to 4 pounds for each calf, but some of them began to scour and the allowance of meal was quickly reduced. The calves in lots 2 and 3 received a partial feed of corn-and-cob meal; this was mixed with the cottonseed meal, so the daily allowance of concentrated feeds for the calves of these two lots was greater than that of the calves in lot 1. During the preliminary period each calf in lot 2 received a daily feed of 2.6 pounds of concentrated feeds, practically one-fourth of the amount being corn-and-cob meal. Each calf in lot 3, during the same period, received 3.05 pounds daily of the concentrated feeds, 55.4 per cent of which was corn-and-cob meal. At the end of the test each calf in lot 3 was eating 6 pounds daily of a mixture of one-third cottonseed meal and two-thirds corn-and-cob meal. They ate this amount readily with no ill results following.

It should be noted that when the amount of feed was increased it was increased gradually. No abrupt changes were made.

WEIGHTS AND GAINS.

When the preliminary weights were taken, November 18, 1910, the calves averaged from six to eight months in age. While they were not large for their age, they were larger than the average for the State. Their mothers probably averaged about 1,000 pounds in weight in usual breeding condition. The calves had not been pampered in any way during the summer months; they had simply run with their mothers upon a reasonably good pasture.

In some previous experimental work done by this bureau and the Alabama Experiment Station, yearling grade Angus calves attained a weight of only 402 pounds, but they were heavily infested with ticks. Some ticks were permitted to get on the calves used in the present test, but they were not badly infested. Of course, this slight infestation retarded their development, but just how much it is impossible to state.

The table below shows that the calves made satisfactory gains during the winter feeding periods.

TABLE 2.—*Weights, total gains, and average daily gains.*

PRELIMINARY PERIOD (NOV. 17 TO DEC. 7).

Lot.	Number of calves.	Ration.	Number of days fed.	Average initial weight of each calf.	Average final weight of each calf.	Average total gain of each calf.	Average daily gain of each calf.
				Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
1	27	Cottonseed meal, Cottonseed hulls, Mixed alfalfa hay	19	338	380	42	2.21
2	24	Cottonseed meal, two-thirds, Corn-and-cob meal, one-third, Cottonseed hulls, Mixed alfalfa hay	19	333	374	41	2.16
3	26	Cottonseed meal, one-third, Corn-and-cob meal, two-thirds, Cottonseed hulls, Mixed alfalfa hay	19	328	367	39	2.05

REGULAR FEEDING PERIOD (DEC. 8, 1910, TO MAR. 17, 1911).

1	27	Cottonseed meal, Cottonseed hulls, Mixed alfalfa hay	100	380	541	161	1.61
2	24	Cottonseed meal, two-thirds, Corn-and-cob meal, one-third, Cottonseed hulls, Mixed alfalfa hay	100	374	543	169	1.69
3	26	Cottonseed meal, one-third, Corn-and-cob meal, two-thirds, Cottonseed hulls, Mixed alfalfa hay	100	367	546	179	1.79

PRELIMINARY AND REGULAR PERIODS COMBINED (NOV. 17, 1910, TO MAR. 17, 1911).

1	27	Cottonseed meal, Cottonseed hulls, Mixed alfalfa hay	119	338	541	203	1.71
2	24	Cottonseed meal, two-thirds, Corn-and-cob meal, one-third, Cottonseed hulls, Mixed alfalfa hay	119	333	543	210	1.76
3	26	Cottonseed meal, one-third, Corn-and-cob meal, two-thirds, Cottonseed hulls, Mixed alfalfa hay	119	328	546	218	1.83

During the preliminary period from November 17 to December 7 the calves were dehorned and the males castrated, yet they made excellent gains. The lots gained a daily average of 2.21, 2.16, and 2.05 pounds, respectively, during this period. Of course some of this increase can be attributed to "fill"; it was not all real gain in terms of meat and bone.

During the regular experiment from December 8 to March 17 the gains were also entirely satisfactory. The calves in lot 1, the lot which had no corn-and-cob meal mixed with cottonseed meal, made the smallest gains, each calf gaining 1.61 pounds a day; this, however, was a satisfactory daily gain for small and young animals. The calves in lot 3, the lot which was given the heavy feed of corn-and-cob meal along with the cottonseed meal, made the greatest

gains, each calf gaining 1.79 pounds daily. The calves in lot 2, the lot which received the small amount of corn-and-cob meal along with the cottonseed meal, made an average daily gain of 1.69 pounds.

During the whole winter feeding period each calf gained an average of 203, 210, and 218 pounds in weight in lots 1, 2, and 3, respectively, so that when the calves were sold, March 17, the whole lot of 77 calves averaged 543 pounds in weight. They were practically 12 months old when sold.

It should not be inferred that the ration which produced the greatest gain in a given time is necessarily the best or most profitable one. While the question of rapidity of gain is an extremely important factor in final profits, there are other factors, as the cost of the gain, which must be taken into consideration.

QUANTITY AND COST OF FEED REQUIRED TO MAKE 100 POUNDS GAIN.

While the feeds used were all expensive ones, the cost to make 100 pounds of gain in live weight was not excessive. In fact, the gains were made cheaply. This was due to several factors. First, the calves were young and growing, and young animals of all kinds can be made to increase in weight more economically than old ones. Second, the calves were very thrifty, and so made good use of the feed that they ate. Third, all of the rations were extremely palatable, especially the two which had the corn-and-cob meal mixed with the cottonseed meal. A young animal of any kind will not make satisfactory gains on an unpalatable ration. Fourth, the calves had comfortable quarters and were fed and watered regularly.

TABLE 3.—*Quantity and cost of feed required to make 100 pounds of gain.*

Lot.	Ration.	Preliminary period—19 days (Nov. 17 to Dec. 7).		Regular feeding period—100 days (Dec. 8 to Mar. 17).		Preliminary and regular periods combined—119 days (Nov. 17 to Mar. 17).	
		Pounds of feed to make 100 pounds of gain.	Cost of feed to make 100 pounds of gain.	Pounds of feed to make 100 pounds of gain.	Cost of feed to make 100 pounds of gain.	Pounds of feed to make 100 pounds of gain.	Cost of feed to make 100 pounds of gain.
		Pounds.	*Dollars.*	*Pounds.*	*Dollars.*	*Pounds.*	*Dollars.*
1	Cottonseed meal	95	3.80	201	6.85	179	6.22
	Cottonseed hulls	241		486		435	
	Mixed alfalfa hay	230		338		315	
2	Cottonseed meal, two-thirds	88	4.40	143	6.63	133	6.19
	Corn-and-cob meal, one-third	40		72		65	
	Cottonseed hulls	266		464		425	
	Mixed alfalfa hay	257		323		310	
3	Cottonseed meal, one-third	66	4.51	114	6.95	130	6.83
	Corn-and-cob meal, two-thirds	103		234		211	
	Cottonseed hulls	261		430		400	
	Mixed alfalfa hay	228		216		218	

During the preliminary period the calves made both rapid and economical gains, notwithstanding the fact that they had been dehorned and castrated. It cost $3.80, $4.40, and $4.51 to make 100 pounds of gain in live weight in lots 1, 2, and 3, respectively, during the preliminary period. In this period, therefore, the calves which ate nothing except cottonseed meal, hulls, and alfalfa hay made the cheapest gains. This, however, was not true of the test when taken as a whole.

After the calves had been on feed some weeks, with the "fill" not taken into consideration, the gains were not made as cheaply as at first. Under average feeding conditions the cheapest gains are made during the first few weeks of the fattening process; the expensive gains are usually made near the close of the feeding period. During the regular feeding period it cost $6.85, $6.63, and $6.95 to make 100 pounds of gain in lots 1, 2, and 3, respectively. The cheapest gains were by the calves in lot 2, where the small amount of corn-and-cob meal was fed along with the cottonseed meal. The most expensive gains were made in lot 3, where the calves received a heavy proportion of corn-and-cob meal.

The cost of the gains, however, does not determine absolutely the final profits. While the cost of the gains is a very important factor in determining final profits, there are other factors which must be taken into consideration as well. The final selling price of the cattle must also be considered as an important factor. If expensive gains are accompanied by a proportionate increase in the final value and selling price of the cattle, the cost of the gains is a minor consideration; but if expensive gains do not increase the final selling price of the animal in proportion to the increased expense of making the gains, those feeds which have caused the expensive gains should be eliminated.

When the preliminary and the regular periods are combined into one period of 119 days, it cost $6.22, $6.19, and $6.83 to produce 100 pounds of gains in lots 1, 2, and 3, respectively, lot 2 still showing up to the best advantage and lot 3 to a considerable disadvantage.

PRICES REALIZED ON EACH KIND OF FEED WHEN PRICES OF THE OTHER FEEDS ARE FIXED.

As previously stated, the cottonseed meal cost $26 a ton and the hulls $7 a ton, the hay being valued at $15 a ton and the corn at 70 cents a bushel. Before a farmer spends $26 for a ton of cottonseed meal and $7 for a ton of hulls to be used as a feed for cattle he should know whether or not he will get his money back in the shape of profits on the cattle. In other words, the farmer should know whether he will be able to realize a profit on the money invested in the feed. When he has hay and corn on his farm he expects to sell

them at the highest possible price. When, in addition, he has cattle the farmer often hesitates as to the best method of disposing of the corn and hay. The question arises in his mind, Should I feed the hay and corn to the calves and steers, or should I sell these feeds directly upon the market?

The following table throws some light on this problem:

TABLE 4.—*Prices realized on each feed when fed to the calves and prices of the other feeds are fixed.*

Feed.	Lot 1.	Lot 2.	Lot 3.
Cottonseed meal.....per ton..	$36.10	$42.18	$36.50
Cottonseed hulls.....do....	11.15	12.05	10.40
Corn.....per bushel..	.....	1.90	.95
Alfalfa hay.....per ton..	20.72	20.92	21.25

While the cottonseed meal cost only $26 a ton, it was fed to the calves and sold, by means of them, for $36.10 to $42.18 a ton. The hulls cost only $7 a ton, and they were resold, by means of the calves, for $10.40 to $12.05 a ton. If the corn had been sold upon the market it would not have brought more than 60 cents a bushel during the fall of 1910 (it is charged against these calves, however, at 70 cents a bushel), but when it was fed to these calves it was sold, by means of the calves, for 95 cents a bushel in lot 3 and $1.90 a bushel in lot 2. If the mixed alfalfa hay had been sold as hay, it would not have brought more than $15 a ton on the farm, but it was sold, through the calves, for $20.72 to $21.25 a ton.

These results tend to show that the farmer can usually afford to buy certain outside feeds—feeds which have not been grown on the farm—for feeding his animals, while he can almost always afford to feed his home-grown feeds to live stock rather than sell them upon the market.

FINANCIAL STATEMENT.

These calves were raised on the farm on which they were fattened, so the initial or fall price is an estimated one. Their estimated value was placed at 3½ cents a pound on the farm, without shrink, when these experiments began, November 17, 1910.

When they were ready to be sold, buyers visited the farm to make bids. At the time of sale the beef market was on a rapid decline, so they did not sell as well as was expected. They were sold March 17, 1911, the calves in lot 1 selling for $5.01 per hundredweight on the farm, those in lot 2 bringing $5.11 per hundredweight, and those in lot 3 selling for $5.26 per hundredweight. All the sales were based on the farm weight after a 3 per cent shrink. They were shipped to the Cincinnati market, where complete slaughter records were secured.

TABLE 5.—*Financial statement.*

Lot 1. Cottonseed meal, cottonseed hulls, mixed alfalfa hay:		
By sale of 27 calves, 14,172 pounds, at $5.01 per hundredweight		$710.02
To 27 calves, 9,120 pounds, at 3½ cents a pound	$319.20	
To 9,821 pounds cottonseed meal, at $26 a ton	127.67	
To 23,908 pounds cottonseed hulls, at $7 a ton	83.68	
To 17,320 pounds mixed alfalfa hay, at $15 a ton	129.90	
Total expense		660.45
Total profit		49.57
Profit per calf		1.84
Lot 2. Cottonseed meal two-thirds, corn-and-cob meal one-third, cottonseed hulls, mixed alfalfa hay:		
By sale of 24 calves, 12,633 pounds, at $5.11 per hundredweight		$645.55
To 24 calves, 7,984 pounds, at 3½ cents a pound	$279.44	
To 6,682 pounds cottonseed meal, at $26 a ton	86.87	
To 3,298 pounds corn-and-cob meal, at 70 cents a bushel	32.98	
To 21,418 pounds cottonseed hulls, at $7 a ton	74.96	
To 15,630 pounds mixed alfalfa hay, at $15 a ton	117.23	
Total expense		591.48
Total profit		54.07
Profit per calf		2.25
Lot 3. Cottonseed meal one-third, corn-and-cob meal two-thirds, cottonseed hulls, mixed alfalfa hay:		
By sale 26 calves, 13,774 pounds, at $5.26 per hundredweight		$724.51
To 26 calves, 8,531 pounds, at 3½ cents a pound	$298.59	
To 7,353 pounds cottonseed meal, at $26 a ton	95.59	
To 11,963 pounds corn-and-cob meal, at 70 cents a bushel	119.63	
To 22,687 pounds cottonseed hulls, at $7 a ton	79.40	
To 12,363 pounds mixed alfalfa hay, at $15 a ton	92.72	
Total expense		685.93
Total profit		38.58
Profit per calf		1.48

The foregoing shows that all of the calves were fed at a profit, the lowest being $1.48 per calf in lot 3 and the highest $2.25 per calf in lot 2. What do these profits mean? They mean that the corn and hay raised on the farm were sold, through the calves, at 70 cents a bushel and $15 a ton, respectively; that the money expended for cottonseed meal and hulls was all returned to the owner; that the fertilizer value of these feeds was left on the farm, and, in addition, each calf returned the above additional profits. The monetary returns were satisfactory, as the farm feeds were sold for more, by means of the calves, than could have been secured for them on the market, and their fertilizing value was left on the farm in the shape of barnyard manure.

The calves in lot 3, the ones which received the heavy ration of corn-and-cob meal, returned the smallest profit, notwithstanding the fact that they sold for the highest price at Cincinnati. The increase in the price did not overcome the added expense of feeding a heavy ration of corn-and-cob meal. While it did not pay to feed the heavy ration of corn-and-cob-meal, it did pay to feed the small amount of corn-and-cob meal which was used in lot 2, as the calves in this lot proved to be the most profitable ones fed. This indicates that when fattening beef calves with cottonseed meal and corn-and-cob meal as concentrates one-third of the concentrated part of the ration can profitably consist of corn-and-cob meal, while it is less profitable to have corn-and-cob meal constitute two-thirds of the concentrated part of the ration.

However, there is one factor that has not been taken into consideration which, if considered, would add to the profits of lots 2 and 3, especially the latter. Some undigested corn passed through the calves in these two lots; if hogs followed them they would derive no little benefit from the droppings. In fact, several hogs did follow the calves in lot 3, but no record was kept of their gains. These gains should be credited to the calves.

SLAUGHTER RECORDS.

As stated before, these calves were all shipped to the Cincinnati market, where full slaughter data were secured. The animals were driven 9 miles from the farm to the railroad, and on account of unusual delays they were on the cars 67 hours before reaching Cincinnati. The slaughter results are given in the following table:

TABLE 6.—*Slaughter data*

Lot.	Number of calves.	Live weights.			Shrinkage.		Per cent dressed.	
		Total on farm.	On farm after 3 per cent shrink.	At Cincinnati.	Total.	Average per calf.	By shrunk farm weight.	By market weight.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*
1	27	14,610	14,172	13,050	1,560	57.8	47.6	51.7
2	24	13,024	12,633	11,740	1,284	53.5	47.8	51.5
3	26	14,200	13,774	12,700	1,500	57.7	48.9	53.1

The calves of lot 3, the ones which received the large proportion of corn-and-cob meal, dressed out the highest, each calf in this lot dressing 53.1 per cent of the market weights. The calves in lots 1 and 2 dressed out 51.7 and 51.5 per cent, respectively.

The trip was a hard one on the calves, and when the size of the animals is taken into consideration they shrank heavily on the road to Cincinnati. The average loss in weight for each calf was 57.8 pounds in lot 1, 53.5 pounds in lot 2, and 57.7 pounds in lot 3.

SUMMARY.

The first experiment is summarized as follows:

TABLE 7.—*Summary statement.*

Item.	Lot 1.	Lot 2.	Lot 3.
Calves in each lot	27	24	26.
Ration	Cottonseed meal Cottonseed hulls Mixed alfalfa hay	Cottonseed meal, two-thirds. Corn-and-cob meal, one-third. Cottonseed hulls Mixed alfalfa hay	Cottonseed meal, one-third. Corn-and-cob meal, two-thirds. Cottonseed hulls. Mixed alfalfa hay.
Total days fed	119	119	119.
Average weight when feeding began.	338 pounds	333 pounds	328 pounds.
Average final weight	541 pounds	543 pounds	546 pounds.
Average gain of each calf	203 pounds	210 pounds	218 pounds.
Average daily gain of each calf.	1.71 pounds	1.76 pounds	1.83 pounds.
Pounds feed to make 100 pounds gain.	179 pounds meal 435 pounds hulls 315 pounds hay	133 pounds meal 65 pounds corn 425 pounds hulls 310 pounds hay	130 pounds meal. 211 pounds corn. 400 pounds hulls. 218 pounds hay.
Cost to make 100 pounds gain.	$6.22	$6.19	$6.83.
Price realized on each ton of cottonseed meal when other prices are fixed.	$36.10	$42.18	$36.50.
Price realized on each ton of hulls when other prices are fixed.	$11.15	$12.05	$10.40.
Price realized on each bushels of corn when other prices are fixed.		$1.90	$0.95.
Price realized on each ton of hay when other prices are fixed.	$20.72	$20.92	$21.25.
Fall price of calves per cwt.	$3.50	$3.50	$3.50.
Selling price of calves per cwt.	$5.01	$5.11	$5.26.
Profit on each calf above all expenses.	$1.84	$2.25	$1.48.

1. The animals used in the experiment were calves ranging from 6 to 8 months in age.

2. The feeding was begun November 17, 1910, and continued until March 17, 1911.

3. The 77 calves were divided into three lots and each lot fed upon the following feeds:

Lot 1. Cottonseed meal; cottonseed hulls; mixed alfalfa hay. Lot. 2. Cottonseed meal, two-thirds; corn-and-cob meal, one-third; cottonseed hulls; mixed alfalfa hay. Lot 3. Cottonseed meal, one-third; corn-and-cob meal, two-thirds; cottonseed hulls; mixed alfalfa hay.

4. During the whole feeding period each calf in lots 1, 2, and 3 made an average daily gain of 1.71, 1.76, and 1.83 pounds, respectively.

5. When the whole feeding period is taken into consideration the following pounds of feed were required to make 100 pounds of gain:

Lot 1: 179 pounds of cottonseed meal, 435 pounds of hulls, and 315 pounds of hay. Lot 2: 133 pounds of cottonseed meal, 65 pounds of corn-and-cob meal, 425 pounds of hulls, and 310 pounds of hay.

Lot 3: 130 pounds of cottonseed meal, 211 pounds of corn-and-cob meal, 400 pounds of hulls, and 218 pounds of hay.

6. When the whole feeding period is taken into consideration, each 100 pounds of gain in lots 1, 2, and 3 cost $6.22, $6.19, and $6.83, respectively.

7. Cottonseed meal cost $26 a ton, but, by means of the calves, was sold for $36.10, $42.18, and $36.50 a ton in lots 1, 2, and 3, respectively, when the prices of the other feeds were fixed.

8. Cottonseed hulls cost $7 a ton, but, by means of the calves, each ton was sold for $11.15, $12.05, and $10.40 in lots 1, 2, and 3, respectively, when the prices of the other feeds were fixed.

9. By means of the calves each bushel of corn was sold for $1.90 and $0.95 in lots 2 and 3, respectively, when the prices of the other feeds were fixed.

10. By means of the calves each ton of alfalfa hay was sold for $20.72, $20.92, and $21.25 in lots 1, 2, and 3, respectively, when the prices of the other feeds were fixed.

11. The calves cost $3.50 per hundredweight at the beginning of the test. At the close they sold for $5.01, $5.11, and $5.26 per hundredweight in lots 1, 2, and 3, respectively.

12. Each calf netted a clear profit of $1.84, $2.25, and $1.48 in lots 1, 2, and 3, respectively.

13. The profits were satisfactory, as the farm crops were sold for considerably more, by means of the calves, than if they had been sold as farm crops, and the value of the fertilizer should also be considered.

II. FATTENING CALVES IN WINTER ON COTTONSEED MEAL, COTTONSEED HULLS, AND PEA-VINE HAY.

Fifty-two calves were used in the second experiment, the main objects of which were:

1. To determine whether or not young beef calves can be fattened profitably for the spring market on a feed of cottonseed meal, cottonseed hulls, and mixed pea-vine hay.

2. To study the value of shelter for young calves while being fattened.

The 52 calves were divided into two lots when the test began on December 7, 1910. One lot was fed under the shelter of a good barn, the other lot being fed in a corn-stalk field with no shelter at all except some trees. It was subsequently seen, however, that these young calves would not thrive during the winter months without a shelter to turn the cold rains, so on February 11, 1911, they were brought into the barns and placed under the sheds with the other calves. After February 11 the 52 head of calves were fed as one lot.

The work was done in cooperation with Mr. E. F. Allison, of Sumter County, Ala., who had kindly agreed to cooperate in experimental work with beef cattle and hogs. Mr. Allison furnished the calves and the feed, while the bureau and the experiment station provided a trained man to be stationed on the farm to look after the experiment. Mr. L. W. Shook lived on the farm and had personal charge of the work.

THE CALVES.

The majority of the calves used in this experiment were raised on the farm of Mr. Allison, near Bellamy, Ala. A few calves were purchased from neighbors. More than half of those raised on Mr. Allison's farm were grade Aberdeen-Angus of excellent quality. The ones which were purchased from neighbors were of common quality and showed very little beef blood. As a whole, they were not as large or as good in quality as were the calves which were used in the other two tests reported in this bulletin. When the test began they had attained an average weight of 313 pounds. The calves were born during the spring of 1910, so were from 6 to 8 months old when the test began, December 7, 1910. They were valued at 3 cents a pound at the beginning of the experiment.

PLAN OF THE WORK.

At the beginning of the test the 52 calves were divided into two lots of 26 each. One lot was fed in a small paddock, across the west side of which extended a good shelter. As previously stated, the intention at first was to feed the second lot of calves without shelter; that is, they were to be fed in a cornfield where no shelter, except trees, was available. All were started on feed December 7, 1910, but it was seen that the calves without shelter were not making satisfactory and economical gains, as the winter was unusually wet and cold, so on February 11, 1911, the field lot of calves was brought to the barn and placed with the other calves. The whole 52 head were fed together in one lot from February 11 to the end of the test, March 29, 1911.

On account of the fact that the two lots were finally thrown together into one, the test is presented in this publication as one lot.

PRICES AND QUALITY OF FEEDS.

Cottonseed meal, cottonseed hulls, and mixed cowpea hay were the feeds used. The cowpea hay was grown upon the farm; the other two feeds were purchased on the market. On March 20, 1911, the supply of cowpea hay was exhausted and a change was made to a rather poor quality of hay, composed of crab grass, with a small trace of Lespedeza and pea vines. The feeds were valued as follows:

Cottonseed meal	per ton..	$26.00
Cottonseed hulls	do....	7.00
Mixed pea-vine hay	do....	15.00

DAILY RATIONS.

During the first month no hay was fed, but it was thought that it would be profitable to use some hay along with the hulls, so it was provided after the first month.

It should be remembered in studying the following daily feeds that these were young and small calves. Their average weight was only 313 pounds when the test began.

TABLE 8.—*Daily ration for each calf, by monthly periods, from Dec. 7, 1910, to Mar. 29, 1911.*

Period.	Cottonseed meal.	Cottonseed hulls.	Hay.
	Pounds.	*Pounds.*	*Pounds.*
First 28 days	2.84	10.20	0
Second 28 days	3.11	10.40	2.04
Third 28 days	3.27	9.94	2.04
Fourth 28 days	3.09	9.50	1.92

During no period did the calves average more than 3.27 pounds each of cottonseed meal daily. Even with this small allowance of the meal a few calves scoured. They were given a definite number of pounds of hulls along with the meal, and all of the hay they would eat up clean after each meal. They ate, on the average, practically 10 pounds of hulls per calf per day, and slightly more than 2 pounds of hay. Many feeders would criticise these rations as being too small, but satisfactory gains were made.

WEIGHTS AND GAINS.

The calves did not make unusually large gains, but when their size is taken into consideration it is seen that they increased in weight at a reasonable rate. The feeding period was continued for 112 days, and during this time an average daily gain of 1.24 pounds was secured.

TABLE 9.—*Weights and gains for total feeding period of 112 days, from Dec. 7, 1910, to Mar. 29, 1911.*

Number of calves.	Average initial weight of each calf.	Average final weight of each calf.	Average total gain of each calf.	Average daily gain of each calf.
52	*Pounds.* 313	*Pounds.* 452	*Pounds.* 139	*Pounds.* 1.24

At the inauguration of the experiment each calf weighed 313 pounds; at the close they had attained an average weight of 452 pounds; hence, during the feeding period of 112 days (Dec. 7, 1910, to Mar. 29, 1911) each calf made a total gain of 139 pounds. The animals were thrifty throughout the whole test.

QUANTITY AND COST OF FEED REQUIRED TO MAKE 100 POUNDS GAIN.

Considering that these calves were fattened in the winter time and upon dry feeds altogether, the gains as shown in the table below were produced at an unusually small expense. This was due largely to the fact that the animals were young. The younger the animal the more cheaply can the gains be made. As a rule, the feeder can not expect to produce gains as cheaply on mature as on young cattle.

TABLE 10.—*Quantity and cost of feed required to make 100 pounds of gain.*

Number of animals.	Ration.	Pounds of feed required to make 100 pounds of gain.	Cost of feed to make 100 pounds of gain.
52	Cottonseed meal	*Pounds.* 249	$6.97
	Cottonseed hulls	808	
	Mixed cowpea hay	121	

It is seen that 249 pounds of cottonseed meal, 808 pounds of cottonseed hulls, and 121 pounds of hay were required to make 100 pounds of gain; or, when feeds are valued as on page 23, it cost $6.97 to make 100 pounds of increase in live weight.

AMOUNT REALIZED ON EACH TON OF FEED WHEN PRICES OF THE OTHER FEEDS ARE FIXED.

This test again emphasizes the facts, first, that the farmer can well afford to buy commercial feeds for his beef animals during the fattening process, and second, when he has home-raised feeds to sell greater prices can be realized on them when they are sold by means of live stock than when sold upon the general grain or hay market. Each ton of feed used was sold, by means of the calves, for the following prices:

Price realized on each ton of cottonseed meal when other prices are fixed	$46.32
Price realized on each ton of cottonseed hulls when other prices are fixed	13.24
Price realized on each ton of mixed hay when other prices are fixed	56.61

Cottonseed meal cost $26 a ton, but it was sold, by means of the calves, for $46.32 a ton. The cottonseed hulls cost $7 a ton and this sum was nearly doubled by means of the calves, the price realized being $13.24 a ton. The price realized on the hay was, of course, abnormally high, as not much hay was fed; only 4.37 tons were used throughout the whole test, but this small amount was sold, by means of the calves, for $56.61 a ton when cottonseed meal and hulls are valued at $26 and $7 a ton, respectively.

FINANCIAL STATEMENT.

At the beginning of the experiment the calves were valued at 3 cents a pound. When they were ready to be sold, March 29, 1911, they were shipped to New Orleans, where they sold for an average of $5.55 per hundredweight. All expenses were taken into consideration in the financial statement below, such as freight, feed, yardage, and commission for selling in New Orleans. These calves were not sold by farm weight, so the financial statement is based on New Orleans weights and prices:

TABLE 11.—*Financial statement.*

By sale of 52 calves, 23,212 pounds, at $5.55		$1,288.27
To 52 calves, 16,304 pounds, at 3 cents a pound	$489.12	
To 17,900 pounds of cottonseed meal, at $26 a ton	232.70	
To 58,303 pounds of cottonseed hulls, at $7 a ton	204.06	
To 8,743 pounds of mixed pea-vine hay, at $15 a ton	65.57	
To shipping expenses, commission, yardage, etc., on 52 calves	114.92	
Total expense		1,106.37
Total profit		181.90
Profit per calf		3.50

After all expenses were charged against the calves they netted a clear profit of $3.50 each. This was a satisfactory profit. It cost $2.21 to ship each calf to New Orleans and pay all the selling expenses upon their arrival; the total shipping expense amounted to 49 cents for each 100 pounds live weight.

SLAUGHTER RECORDS.

As stated before, these calves were shipped to New Orleans, where slaughter records were secured. They were driven 3 miles to the railroad at Bellamy, Ala., to be loaded on the cars:

TABLE 12.—*Slaughter data.*

Number of calves.	Live weights.			Shrinkage.		Per cent dressed.	
	Total on farm.	On farm after 3 per cent shrink.	At New Orleans.	Total.	Average per calf.	By shrunk farm weight.	By market weight.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*	*Per cent.*
45	20,475	19,861	19,935	540	12	52.8	52.7

There were 52 calves altogether, but the dressed weights of only 45 were secured. The animals lost an average of 12 pounds each during the trip to New Orleans; this was an unusually small shrinkage. They dressed out 52.7 per cent by New Orleans weights, and 52.8 per cent by farm weights, after a 3 per cent shrink.

SUMMARY.

The second experiment is summarized as follows:

TABLE 13.—*Summary statement.*

Total number of calves		52
Average weight of each calf at beginning of test (Dec. 7, 1910)	pounds	313
Average weight of each calf at end of test (Mar. 29, 1911)	do	452
Average gain of each calf	do	139
Average daily gain each calf for 112 days	do	1.24
Pounds feed required to make 100 pounds of gain: meal	do	249
Pounds feed required to make 100 pounds of gain: hulls	do	808
Pounds feed required to make 100 pounds of gain: hay	do	121
Cost to make 100 pounds of gain		$6.97
Price realized on each ton cottonseed meal, prices of other feeds being fixed		$46.32
Price realized on each ton cottonseed hulls, prices of other feeds being fixed		$13.24
Price realized on each ton hay, prices of other feeds being fixed		$56.61
Value of calves at beginning of test (Dec. 7, 1910)	hundredweight	$3.00
Selling price of calves at New Orleans, Mar. 29, 1911	do	$5.55
Total profit on each calf		$3.50

1. The calves used in this test were from 6 to 8 months old when the experiment began, December 7, 1910.

2. They were valued at $3 per hundredweight when the test began.

3. At the beginning of the test the calves averaged 313 pounds in weight; at the close (Mar. 29, 1911) they had attained an average weight of 452 pounds. They made an average daily gain of 1.24 pounds.

4. There were required 249 pounds of cottonseed meal, 808 pounds of cottonseed hulls, and 121 pounds of mixed cowpea hay to make 100 pounds of increase in live weight. The cost of 100 pounds gain was $6.97.

5. The price realized for each feed when sold through the calves, and when the prices of the other feeds were fixed, was as follows: Cottonseed meal, $46.32 per ton; cottonseed hulls, $13.24 per ton; pea-vine hay, $56.61 per ton.

6. On March 29, 1911, the calves were shipped to New Orleans and sold for $5.55 per hundredweight. Each calf netted a clear profit of $3.50.

III. WINTERING CALVES FOLLOWED BY FATTENING ON PASTURE.

The third experiment was carried on in cooperation with Messrs. Cobb and McMillan, of Sumter County, Ala. As in the previous test (Part I of this bulletin), these farmers furnished the cattle and the feed, and the Bureau of Animal Industry and the Alabama Experiment Station placed a trained man upon the farm to carry on the experimental work. One of the authors of this bulletin, Mr. W. F. Ward, was stationed on the farm and had personal supervision of the test.

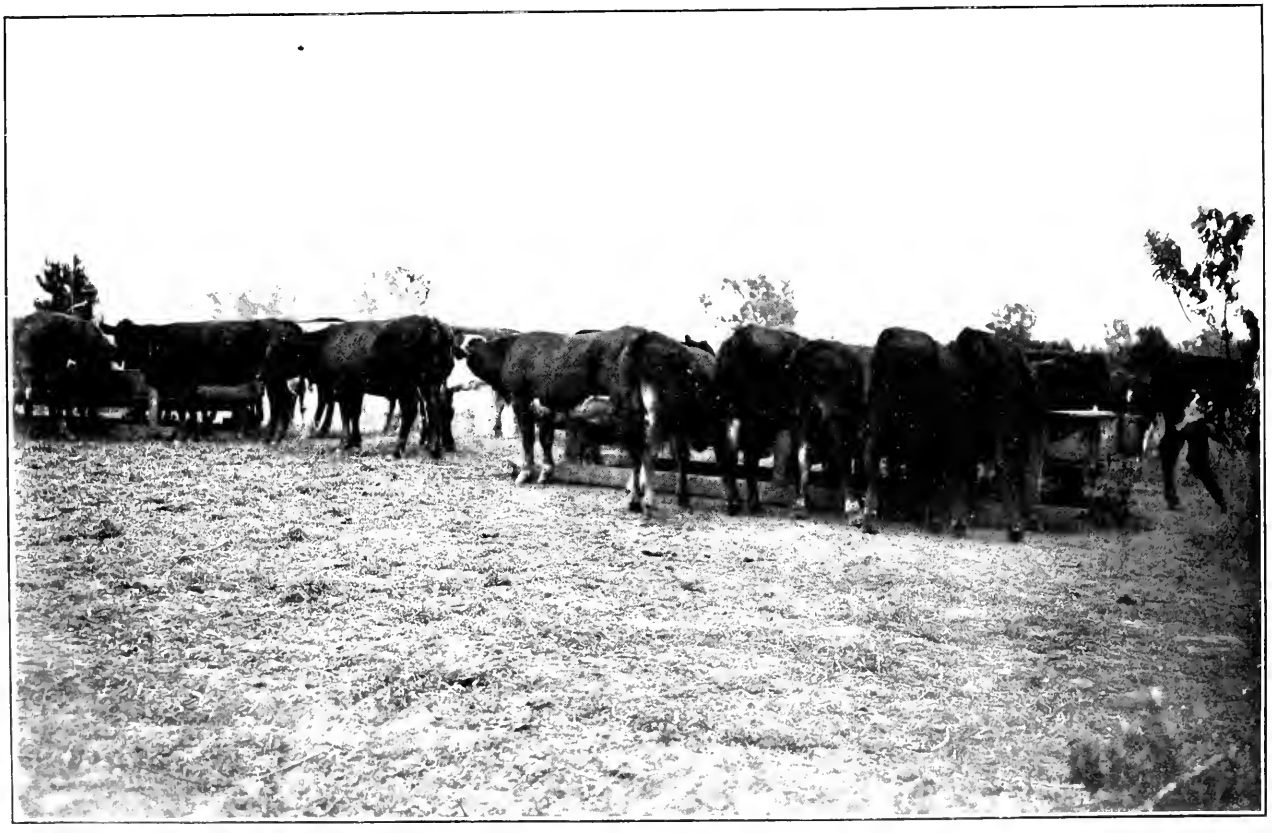
PLAN AND OBJECT OF THE WORK.

The calves in this experiment were born during the spring of 1909. During the summer of 1909 they were with their mothers on a reasonably good pasture and received no particular attention except being salted regularly. When fall arrived and the pastures were exhausted they were taken from their mothers, weaned, tagged, dehorned, and the males castrated. They were then put up in an acre lot in which there was no grass, and were fed all winter on a ration of cottonseed meal, corn chop, cottonseed hulls, and mixed alfalfa hay. The object was to give them sufficient feed to produce good gains all through the winter months, but not to fatten them for the market until the pasture was available in the following spring. By the latter part of March, 1910, sweet clover (Melilotus) had appeared, so the calves were changed from the winter feed to this pasture and fed some cottonseed cake and alfalfa hay in addition. They were kept upon this pasture until June 22, 1910, when they were sold. During the latter part of the grazing season there was some Japan clover (Lespedeza) and Bermuda in the pasture. During all this time the calves were given a small daily feed of cottonseed cake along with the pasture.

The object of the work was to determine the profit, if any, in handling and feeding beef calves in accordance with the above plan.

THE CALVES.

The 34 calves used in this test were a good grade; none of them was purebred, but the majority contained from one-half to three-fourths of Aberdeen-Angus, Hereford, or Shorthorn blood. The majority of the calves were raised on the farm where the experimental work was done; some few of them, however, were purchased from neighbors just before the inauguration of the experiment. As before



Calves Fattening on Pasture. Condition of Animals Five Weeks Before End of Test (Part III).

stated, they had all been born during the spring of 1909, so were from 7 to 8 months old when they were first weighed, December 3, 1909. For their age they were not large, although they were larger than the average calves of the State. At the beginning of the work their average weight was 386 pounds.

FEED AND MANAGEMENT.

December 3, 1909, the calves were placed in the acre lot, in which was a good shed that afforded ample protection from cold rains and wind. On the above date the winter feeding began. They were salted at regular intervals. Good, clean, fresh water was kept in troughs all of the time. The hay racks and the feed bunks or troughs were all under shelter so that the calves could eat in a comfortable place no matter how inclement the weather became. During the winter months they were fed twice daily, once early in the morning and again an hour or so before dark.

When the grass appeared in the spring (March 22, 1910) each calf was weighed and all were turned upon the pasture to be fattened on grass. While on pasture they were fed only once a day, and this was done about sundown, or in the cool part of the afternoon, so that all would come out to the feed troughs. The feed, which consisted of cottonseed cake and alfalfa hay, was not thrown upon the ground; the cake was placed in feed troughs situated at convenient places in the pastures, and the hay was fed from hay racks. When cattle are thus fed in properly constructed hay racks and troughs practically no feed is wasted.

The pasture was not free from ticks, so the calves became slightly infested. However, they were dipped at irregular intervals, and very few ticks appeared on them. No Texas fever cases developed.

A good supply of water was afforded by a creek and an artificial pool.

THE PASTURE.

In the western part of Alabama sweet clover (Melilotus) appears earlier than any other pasture plant. In the spring of 1910 this clover pasture was ready for grazing by March 22, but it did not afford complete and satisfactory grazing at this early date. However, no hay was used to supplement the pasture until April 29, when a small allowance of freshly cut alfalfa hay was added to the pasture and cake ration. Later on in the season the sweet clover died down, when Japan clover (Lespedeza), some Bermuda, and carpet grass constituted the main grazing plants.

The pasture had been in cultivation during the season of 1909, so did not furnish ample grazing, as the grasses had not become thoroughly established. Still the calves made good and economical gains during the pasture season. The 34 animals were grazed upon a field which contained practically 100 acres.

CHARACTER AND PRICES OF FEEDS.

Cottonseed meal, cottonseed cake, cottonseed hulls, corn chop, and freshly cut alfalfa hay were all used at various times throughout the test. The purchased feeds were charged against the calves at the market prices. Estimated prices, corresponding as nearly as possible to the market prices, were placed upon the two feeds which were grown upon the farm. The following prices were placed upon the feeds:

Cottonseed meal	per ton	$26.00
Cottonseed cake (broken)	do	26.00
Cottonseed hulls	do	7.00
Corn chop	per bushel	.70
Alfalfa hay	per ton	15.00
Pasture	per head per month	.50

During the winter months a hay made up of a mixture of Johnson grass and alfalfa was fed, but that which was fed along with the pasture was practically all freshly cut alfalfa. The corn, which was grown on the farm, was used in the shape of corn chop, the shelled corn being run through a grinder which crushed the grain into a coarse meal. The cottonseed meal and the cottonseed cake were both purchased from a near-by oil mill. The cake had been broken into nut size and sacked; this had been done at the mill. All of the feeds were of good quality.

DAILY RATIONS.

As noted in the early part of this bulletin, young animals must be fed with a great deal of care and skill; they require more care and attention than steers and oxen. These calves were fed at practically the same hour each day, and received a definite amount of feed. This daily allowance of feed was limited, and it was expected that the troughs would be clean within an hour after each feeding.

TABLE 14.—*Daily feed for each calf for the whole period (Dec. 3, 1909, to June 22, 1910).*

Period.	Daily ration.	
	Winter period (Dec. 3 to Mar. 24).	Pasture period (Mar. 25 to June 22).
	Pounds.	*Pounds.*
First 28 days	2.18 cottonseed meal. 1.38 corn chop. 3.93 mixed alfalfa hay. 7.13 cottonseed hulls.	3.23 cottonseed cake.
Second 28 days	1.68 cottonseed meal. 2.40 corn chop. 3.99 mixed alfalfa hay. 7.23 cottonseed hulls.	3.85 cottonseed cake. 1.59 alfalfa hay.
Third 28 days	1.38 cottonseed meal. 1.07 corn chop. 3.82 mixed alfalfa hay. 9.39 cottonseed hulls.	5 cottonseed cake. 2.74 alfalfa hay.
Fourth 28 days	1.48 cottonseed meal. .72 corn chop. 3.36 mixed alfalfa hay. 10.24 cottonseed hulls.	5 cottonseed cake.[1] 2.74 alfalfa hay.[1]

[1] Remainder of pasture season, 5 days.

It will be seen that the calves did not get a heavy grain ration at any time. For the first 28 days of the winter period each calf was given practically 3.5 pounds of grain each day; during the second period of 28 days the quantity was raised to 4 pounds for each calf daily. This quantity was too expensive, though, so the grain part of the ration was reduced considerably during the third period of 28 days. The object was to get these calves through the winter as cheaply as possible, and still produce reasonable and steady gains. The pasture was looked forward to as the feed for making rapid and cheap gains, so the high-priced winter feeds were used as sparingly as possible. It will be seen later, however, that the calves made satisfactory gains in the winter months.

During the winter months a definite quantity of cottonseed hulls was weighed out to the animals at each feed. It will be seen that for the first 28 days each calf ate 7.13 pounds of hulls daily, while during the last 28 days the daily allowance was raised to 10.24 pounds. Alfalfa hay was fed ad libitum; they were given all they cared to eat after receiving the regular feed of hulls and concentrates. They did not consume much alfalfa hay, however, as the average was under 4 pounds daily.

When the pasture season arrived, March 25, 1909, the calves were turned upon grass and given an average daily feed of 3.23 pounds of cottonseed cake for the first 28 days. The pasture was not good at this early date, and the calves made only 0.23 of a pound average daily gain per head during the first period. It would probably have been profitable at this time to have supplemented the pasture with some alfalfa hay, but the hay could not be secured. By April 29 a new crop of alfalfa had been cut, so that date marked the beginning of the use of the hay. After this date hay was fed each day until the calves were sold. During the last 33 days of the test each calf was given a daily feed of 5 pounds of cottonseed cake and 2.74 pounds of alfalfa hay along with the pasture.

WEIGHTS AND GAINS.

These calves were larger than those used in the test reported in Part I. When the test began the calves averaged 386 pounds in weight; when it closed, they averaged 628 pounds, or they made an average total gain of 242 pounds each from December 3, 1909, to June 22, 1910. Taken as a whole, the gains were entirely satisfactory.

TABLE 15.—*Total and daily gains.*

Period.	Number of calves.	Number of days fed.	Average initial weight of each calf.	Average final weight of each calf.	Average total gain of each calf.	Average daily gain of each calf.
			Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Winter period (Dec. 3, to Mar. 24).....	34	112	386	512	126	1.13
Pasture period (Mar. 25 to June 22).....	34	89	509	628	119	1.33

The calves were in the test 201 days. For the first 112 days they were on dry winter feed; during the final 89 days they were on pasture. Each calf made an average total gain of 126 pounds from December 3, 1909, to March 24, 1910, or an average daily gain of 1.13 pounds. This was satisfactory. On March 24, they averaged 512 pounds in weight and were from 11 to 12 months of age.

During the pasture season of 89 days (March 25 to June 22), the calves made an average total gain of 119 pounds each, or an average daily gain of 1.33 pounds. These gains were also satisfactory, but nothing unusual. When the test closed on June 22 the calves had reached an average weight of 628 pounds. They were from 14 to 15 months old at this time.

QUANTITY AND COST OF FEED REQUIRED TO MAKE 100 POUNDS GAIN.

The table below shows the average daily ration for each calf, the pounds of feed required to make 100 pounds of increase in live weight, and the cost to make the gains. In this connection it should be remembered that these were young and small animals. As a result of their being young and small their daily feed was small and their gains were made economically.

TABLE 16.—*Average daily ration and quantity and cost of feed to make 100 pounds of gain.*

Period.	Ration.	Average daily feed per calf.	Pounds feed to make 100 pounds of gain.	Cost to make 100 pounds of gain.
		Pounds.	*Pounds.*	
Winter period (Dec. 3 to Mar. 24)	Cottonseed meal	1.68	149	$8.63
	Corn chop	1.39	123	
	Cottonseed hulls	8.49	754	
	Mixed alfalfa hay	3.77	335	
Pasture period (Mar. 25 to June 22)	Cottonseed cake	4.06	305	4.84
	Alfalfa hay	1.55	116	

It cost $8.63 to make 100 pounds of gain during the winter period but the same gains were made for only $4.84 when the calves were on pasture and received a partial ration of cottonseed cake and alfalfa hay. This strikingly illustrates the importance and value of pastures. During the winter months expensive gains are almost always encountered, no matter what kind of live stock is being raised or fattened. This condition of affairs is usually due to two factors. First, the feeds which are used during the winter months are the high-priced ones, and, second, smaller gains are usually secured (especially with young and growing stock) during the cold months, and small gains are almost always expensive.

The cost of the summer gains was small compared with that of the winter gains, yet these summer gains were unusually expensive. In

previous pasture-feeding work in this State[1] summer gains have been made for $2.56 to $3.24 per hundred pounds increase in live weight when cake was fed along with the pasture. The short pasture during the early part of the test probably accounts for the expensive gains; the calves made a daily gain of only 0.23 of a pound during the first 28 days of the summer feeding.

PRICES REALIZED FOR FEEDS AS A RESULT OF FEEDING TO CALVES.

It will be seen below that excellent prices were realized upon all of the feeds used during the fattening period. By means of the calves the feeds were sold for a greater price than they would have brought had they been placed upon the open grain or hay markets. The feeds brought the following prices as a result of being fed to the calves:

Cottonseed meal	per ton	$45.93
Corn chop	per bushel	1.37
Cottonseed hulls	per ton	10.99
Hay fed in winter	do	23.89
Cottonseed cake	do	35.82
Alfalfa hay during pasture season	do	21.48
Pasture rental	per head per month	1.06

The cottonseed cake cost $26 a ton, but was resold, by means of the calves, for $35.82 a ton, as above shown. If the hay had been sold on the market it would have brought approximately $15 a ton, but when it was fed to the calves and marketed by means of them each ton realized $21.48 to $23.89. When measured in terms of profits made on the calves, the pasture was rented for $1.06 a month for each calf. If the corn had been hauled to town and sold it would not have brought over 70 cents a bushel, but when it was fed to the calves each bushel realized $1.37. The cottonseed meal and hulls were sold through the calves for $45.93 and $10.99 a ton, respectively.

These results all emphasize the fact that the farmer can usually sell his farm crops by means of some kind of live stock for more than can be obtained for them when placed on the markets as raw farm products.

FINANCIAL STATEMENT.

As stated before, the majority of these calves were raised on the farm where the work was done. As they were not purchased on the open market, an estimated fall value was placed upon them. They were estimated to be worth 3½ cents a pound when the winter work began, December 3, 1909. They were fed through the winter, all feeds being charged against them at the regular market prices, so by the time spring arrived they had cost considerably more than the

[1] See Bureau of Animal Industry Bulletin 131, or Alabama Station Bulletin 151.

above fall price. The following statement shows the complete cost of the calves up to March 25, 1910:

TABLE 17.—*Total cost of the calves on March 25, 1910.*

To 34 calves, 13,118 pounds at 3½ cents (fall value)	$459.13
To 6,414 pounds cottonseed meal at $26 a ton	83.38
To 5,303 pounds of corn chop at 70 cents a bushel	66.21
To 32,356 pounds of cottonseed hulls at $7 a ton	113.25
To 14,380 pounds of mixed alfalfa hay at $15 a ton	107.85
Total cost of calves March 25, 1910	829.82

On March 25, 1910, the 34 calves weighed 17,313 pounds, and their total cost had reached $4.79+ per hundredweight, consequently they were valued at this sum for the pasture work. It cost $10.90 to feed each calf from December 3, 1909, to March 24, 1910.

TABLE 18.—*Results of fattening the calves on pasture.*

By sale of 34 calves, 20,702 pounds, at 5½ cents a pound		$1,138.61
To 34 calves, 17,313 pounds, at $4.79+ per cwt	$829.82	
To 12,291 pounds cottonseed cake at $26 a ton	159.78	
To 4,691 pounds alfalfa hay at $15 a ton	35.18	
To total pasture rent, 89 days (Mar. 25 to June 22), at 50 cents per head per month	50.43	
Total expenses		1,075.21
Total profit		63.40
Profit per calf		1.86

These calves were sold June 22, 1910, for 5½ cents a pound on the farm, after a 3 per cent shrink. They were shipped to the Meridian (Miss.) market for slaughter.

The above shows that a profit of $1.86 was made on each calf after all expenses were taken into account. The financial statement means that the calves were put into the test at 3½ cents a pound in the fall of 1909; that the alfalfa hay which was grown on the farm was sold for $15 a ton; that the corn, which was also produced upon the farm, was disposed of for 70 cents a bushel; and, finally, that an additional profit of $1.86 was made on each calf. This was satisfactory, especially when it is recalled that a large amount of manure was produced while the calves were being fed.

SLAUGHTER RECORDS.

The calves were shipped to Meridian, Miss., for slaughter. They were driven to Scooba, Miss., a distance of 11 miles, to be loaded on the cars. Through a misunderstanding the live weights were not secured at Meridian, but the individual weights of the dressed carcasses were all secured.

TABLE 19.—*Slaughter data.*

Number of calves.	Live weights.		Dressed weight.	Per cent dressed by shrunk farm weight.
	Total on farm.	On farm after 3 per cent shrink.		
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
34	21,342	20,702	11,258	54.4

It will be seen that the calves dressed out, by farm weights, after allowing 3 per cent for shrinkage, 54.4 per cent, which is nearly 2 per cent higher than the best showing of the winter-fed calves in Parts I and II. The carcasses were good ones and made an excellent appearance when hung up in the cooler.

SUMMARY.

TABLE 20.—*Summary Statement.*

Cost of calves fall of 1909	$3.50
Average weight of calves Dec. 3, 1909 ..... pounds..	386
Average daily ration from Dec. 3, 1909, to Mar. 24, 1910:	
Cottonseed meal ..... do....	1.68
Corn chop ..... do....	1.39
Cottonseed hulls ..... do....	8.49
Mixed alfalfa hay ..... do....	3.77
Average weight of calves Mar. 24, 1911 ..... do....	512
Average daily gain during the winter months ..... do....	1.13
Cost to make 100 pounds increase in live weight during the winter months...	$8.63
Cost to feed each calf through the winter months	$10.90
Total cost of calves when put on pasture Mar. 24, 1910 ..... per cwt..	$4.79+
Cost to make 100 pounds increase in live weight on pasture	$4.84
Each ton of cottonseed cake was sold, prices of other feeds being fixed, by means of calves, for	$35.82
Each ton of alfalfa hay was sold, prices of other feeds being fixed, by means of calves, for	$21.48
Selling price of calves on farm, after 3 per cent shrink ..... per cwt..	$5.50
Profit on each calf	$1.86

1. The calves used in this work were of a good grade. They were from 7 to 8 months old when the test began.

2. They were fed through the winter of 1909–10 on cottonseed meal, corn chop, cottonseed hulls, and mixed alfalfa hay. In the spring of 1910 the calves were put in a pasture and finished for the market on pasture, cottonseed cake, and alfalfa hay.

3. During the winter season (Dec. 3, 1909 to Mar. 24, 1910) the calves made an average total gain of 126 pounds, or an average daily gain of 1.13 pounds.

4. During the pasture season (Mar. 25, 1910 to June 22, 1910) the calves made an average total gain of 119 pounds, or an average daily gain of 1.33 pounds.

5. During the winter season 149 pounds of cottonseed meal, 123 pounds of corn chop, 754 pounds of hulls, and 335 pounds of hay, at a total cost of $8.63, were required to make 100 pounds of increase in live weight.

6. During the pasture season 305 pounds of cottonseed cake and 116 pounds of alfalfa hay, at a total cost of $4.84, were required to make 100 pounds of increase in live weight.

7. Each ton of cottonseed cake was sold, by means of the calves, for $35.82 when the other feeds were valued as indicated in this bulletin.

8. Each ton of alfalfa hay was sold, by means of the calves, for $21.48 when the other feeds were valued as indicated in this bulletin.

9. Each ton of cottonseed meal was sold, by means of the calves, for $45.93 when the other feeds were valued as indicated in this bulletin.

10. Each ton of cottonseed hulls was sold, by means of the calves, for $10.99 when the other feeds were valued as indicated in this bulletin.

11. Each bushel of corn chop was sold, by means of the calves, for $1.37 when the other feeds were valued as indicated in this bulletin.

IV. GENERAL STATEMENT.

While the calves in Parts I, II, and III of this bulletin were fattened in different ways and by different methods, all were raised and handled in the same manner up to the time of being placed in the dry lots. All were born during the spring months and ran with their mothers on a reasonably good pasture during their first summer; they ate nothing but mother's milk and pasture grasses during this time. When the pasture season closed, which was practically December 1 each year, the calves were weaned, dehorned, the males castrated, and all placed in feed lots to be fattened. At this time the different methods as previously outlined were introduced. In Part I the calves were divided into three lots and fattened upon cottonseed meal, corn-and-cob meal, cottonseed hulls, and alfalfa hay, for the early spring market; in Part II the calves were all fed in the same lot and finished for the early spring market on cottonseed meal, cottonseed hulls, and pea-vine hay; in Part III they were carried through their first winter on a ration slightly below a full feed and fattened the following summer on pasture supplemented by cottonseed cake and alfalfa hay.

As a matter of fact, the winter feeding should have been inaugurated before December 1, as the calves lost some of their calf fat, due to short pastures and decreased milk supply, before the feeding periods began. In farm practice it would be wise either to begin the winter feeding by November 1 or to have an oat or rye pasture for the young animals to graze upon after the permanent pastures are killed by frost.

To feed calves as these were fed it is best to have them born as early as possible in the spring. This gives them an opportunity to attain a reasonable size and age by the time they are ready for sale the following spring or early summer. The southern markets prefer larger carcasses than the ones obtained from these calves. In some sections of the country, where the cows must be housed during the winter months, it is more desirable to have the calves come in the fall of the year, as the farmer has more time to care for the small animals during the winter than during the summer months, and the calves would be weaned in the spring, a season when their growth is least retarded. In the South, however, where range conditions still obtain, to have the calves come in the fall would involve the risk of losing both the mothers and the offspring.

The calves in Part I were sold March 17, those in Part II March 29, while those in Part III were fattened on pasture during the latter part of the feeding period and not disposed of until June 22. The calves in Parts I and II were practically 1 year old when sold, while those in Part III were from 14 to 16 months of age at the time of slaughter. As stated in the introduction, there are some advantages in selling calves at an early age. On the other hand, the farmer experiences difficulties in feeding young animals which are not encountered in feeding old and mature animals. In the first place, it would seldom, or never, pay to finish a poor grade of young calves for the market, as our markets sharply discriminate against young animals which carry a predominance of Jersey or scrub blood. In the second place, the farmer who feeds young animals of any kind must be a careful and watchful feeder. An old animal may be fed and handled carelessly and satisfactory results still be obtained, but not so with the young animal. A single instance of overfeeding may so derange the intestinal tract of the young animal that further development is impossible.

CONCLUSIONS.

The tests in this bulletin indicate that excellent profits may be made on calves when they are fed properly, handled carefully, and sold in a businesslike way. In Part I a clear profit of $1.84, $2.25, and $1.48 was realized on each calf in their respective lots; in Part II, where nothing was fed except cottonseed meal, cottonseed hulls, and pea-vine hay, a profit of $3.50 was realized on each animal; and in Part III, where the animals were fed a light ration of grain and hay throughout the winter months and finally finished on pasture, $1.86 profit was realized on each calf.

The reader should understand that these different experiments are not directly comparable, but they do, in a general way, teach us some lessons. The difference in profits between the calves in Parts I and II was due largely to the selling price; those in Part II simply sold to greater advantage. This difference in profits in favor of the calves in Part II was not due to the fact that they made gains more economically than those in Part I. On the contrary, the calves in Part I made 100 pounds of gain for $6.22, $6.19, and $6.83 in the respective lots, while the same gain cost $6.97 in Part II. While the calves in Part II were a cheaper grade than those in Part I (being valued at 3 cents a pound when the test began, while those in Part I were valued at 3½ cents a pound), still they sold for practically the same price when placed on the market; there was a difference of one-half a cent a pound in favor of the calves in Part II. The calves in Part I were sold on the Cincinnati market, while those in Part II were shipped to New Orleans. At the present time, and in fact for

some years past, both cattle and hogs have been selling for better prices on the southern than on the northern markets.

While the calves in Part III sold for a better price than those in the other tests, still they were not as profitable as some of the others. The selling price alone does not determine the final profit; other factors must be considered. It is seen that the winter gains in this test were expensive, costing $8.63 to make 100 pounds. While the cost of the subsequent pasture gains was small as compared to the winter gains, they were not sufficiently cheap to overcome the preceding high-priced gains and thereby make a profit that was entirely satisfactory. Notwithstanding the fact that a profit was made on these calves, the authors are of the opinion that a greater profit would have been made if they had been fed more liberally during the winter months and sold in March or April instead of in June. The expensive winter gains were due to the fact that the animals were held below a full ration, which goes to show that the nearer the feeder approaches a mere maintenance ration the more expensive will be the gains. If the calves had been given a full feed, or almost a full feed, during the winter months, their gains would have been considerably greater than they were, and at the same time more economical. The test, however, does illustrate the value of pastures for making cheap gains.

SUMMARY OF CONCLUSIONS.

This experimental work is being continued, but at the present time the following general conclusions, based on the work already done, can be drawn:

1. A farmer may expect to obtain a reasonable profit on beef calves when he raises and fattens them on his farm and sells them when they are 12 to 14 months old. That is, the farmer who feeds his corn and hay to these young animals can realize more on these raw farm products, when sold through the calves, than when sold as corn or hay. At the same time a large amount of manure is made on the farm to enrich the soil.

2. In the South, at least in Alabama at the present time, the calves should be born during the early spring months.

3. The southern feeder has the choice of many different feeds suitable for fattening calves. With reference to the feeds reported in this bulletin the following conclusions are warranted:

(*a*) When fattening calves it pays to feed a ration made up of one-third corn-and-cob meal and two-thirds cottonseed meal, when corn is valued at 70 cents a bushel and meal at $26 a ton.

(*b*) It is not profitable for two-thirds of the concentrated part of the ration to be composed of corn-and-cob meal when the feeds are valued as above.

(*c*) Young calves can be finished for the market at a profit on cottonseed meal, cottonseed hulls, and pea-vine hay, but it is more profitable to introduce corn-and-cob meal to take the place of part of the cottonseed meal.

4. When shall the calves be sold? The tests seem to indicate that it is more profitable to feed a heavy ration and sell the calves at the end of the winter months when prices are normally high, than to hold them until the early summer months. Light winter feeding produces expensive gains. Although the subsequent pasture gains are made much more cheaply than the winter gains, they are not made economically enough to overcome or counteract the preceding high-priced slowly-made winter gains, together with the normal depreciation in the value of cattle from March or April to June or July.

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